RUX06
Experimental Review
for
Technology Transfer

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Overview

Purpose:

- Review RDECOM – UAMBL Experiment FY06 (RUX06) efforts to be transitioned to Future Combat Systems (FCS) Common and Mission crew station developers under a Technology Transfer Agreement.

Outline:

- Collaborators
- Experimental goals
- Review experiments (with preliminary results)
- Discussion and recommendations

Principal Investigators

Critical Collaborators

ALION SCIENCE AND TECHNOLOGY

GENERAL DYNAMICS Robotic Systems

GENERAL DYNAMICS Land Systems

dcs

ROBOTIC RESEARCH

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RUX06 Goals

Autonomous Mobility

- Evaluate the impact of autonomously driven manned vehicles on Soldier capability.
- Examine Soldier performance and workload associated with robotic following.

Mission Planning

- Examine automated planning algorithms to improve Soldier planning speed and accuracy.

HRI Control Device

- Assess usability and impact on training of “scaled” dismounted control devices.

RUX06 Goals

Live-Virtual-Constructive Simulation

- Explore techniques, tactics, and procedures (TTPs) for a Mounted Combat System (MCS) platoon.
- Examine the impact of integrating live assets with virtual and constructive simulation.

Fire Control

- Examine weapons-munitions pairing and target prioritization algorithms to improve Soldier performance.

Local Area Awareness

- Examine Soldiers capability to understand their local environment through indirect vision.

Autonomous Mobility Overview

POCs: Kaleb McDowell, Ph.D., ARL
Patrick Nunez, TARDEC

RUX06 Efforts: X2, *X6 (Field), Pilot (Motion Base)*

Soldiers: Each individual (11) completed the experiment.

General Structure: Soldiers conducted a road march for an MCS vehicle (AM or Indirect Driving) with a 2nd vehicle in robotic following. During the movement, the Soldiers provided local area awareness and planned a recon for a ARV-RSTA.

Primary Areas of Interest:

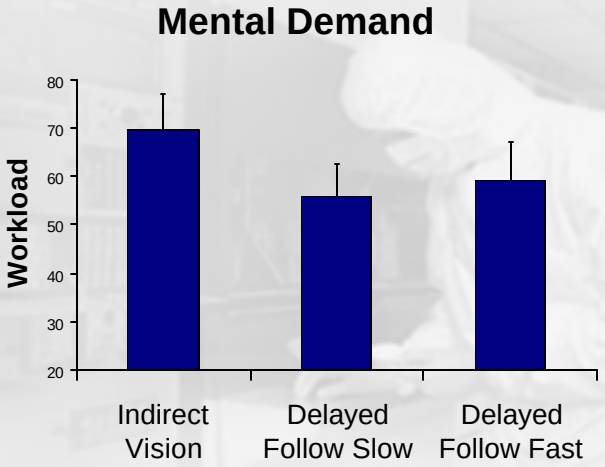
- Two levels of autonomous mobility and indirect vision driving.
- Area awareness during mobility.

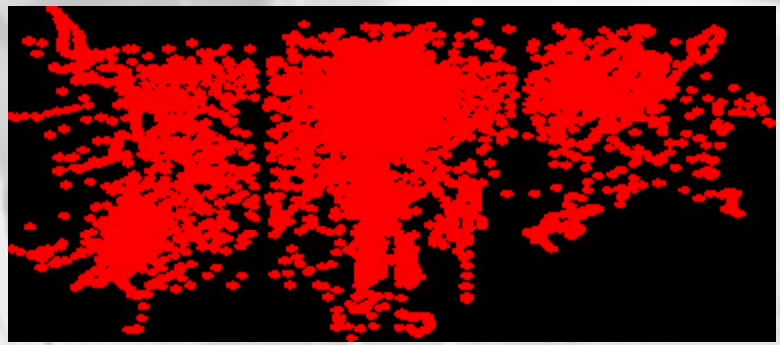
Autonomous Mobility Results

Preliminary Results for X2

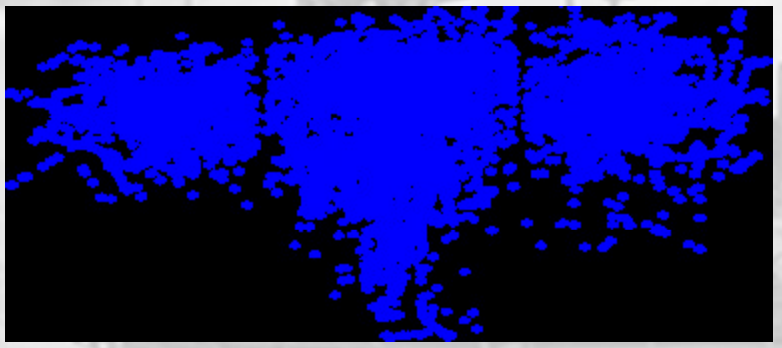
Autonomy associated with:

- Lower Mental Demand than for indirect vision driving.
- Greater percentage of target detection (speed matched) (75% vs. 70%).
- Greater instances of planning under motion (59% *slow*, 50% *fast* vs. 23%).





Sample Subject Eye-tracking Data Indirect Vision Driving (Pilot)



Sample Subject Eye-tracking Data Autonomous (Pilot)

Mission Planning Overview

POCs: Kaleb McDowell, Ph.D., ARL
Patrick Nunez, TARDEC

RUX06 Efforts: X1 (Simulation), *X2 (Field)*

Soldiers: Each individual (12) completed the experiment.

General Structure: Soldiers planned a road march and a movement to contact of an MCS platoon. This process was repeated for manual planning and automated planning.

Primary Areas of Interest:

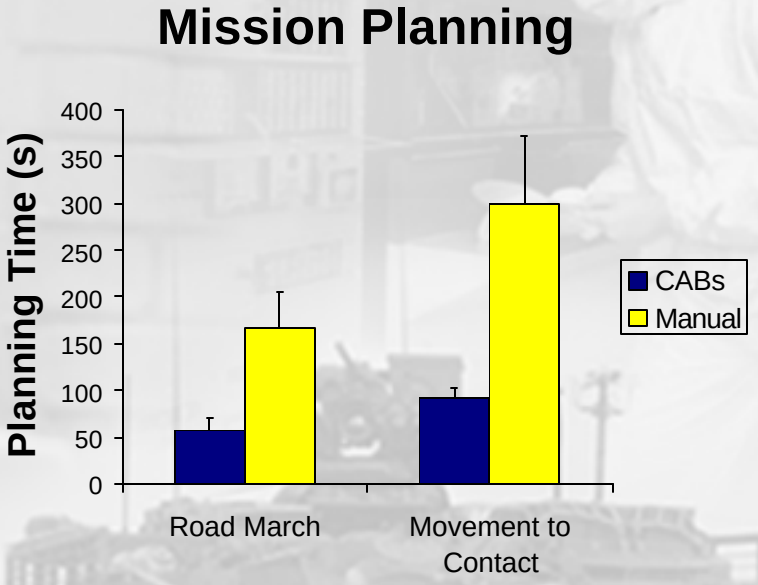
- Manual versus automated planning
- Stationary and motion conditions

Mission Planning Results

Preliminary Results for X1

Crew Aided Behaviors (CABs) associated with:

- Faster planning times.
- Greater time savings with increased plan complexity.



Preliminary Results for X2

CABs associated with:

- Faster planning times.
- Greater instances of planning under motion (64% vs 24%).

HRI Control Device Overview

POCs: Keryl Cosenzo, Ph.D., ARL
Terry Tierney, TARDEC

RUX06 Efforts: X5 (Field)

Soldiers: Each individual (12) completed the experiment.

General Structure: Soldiers teleoperated and waypoint planned a Talon using 2 dismounted control devices.

Primary Areas of Interest:

- NLOS versus LOS teleoperations control of small robots.
- Training
- Display scalability

HRI Control Device Results

Preliminary Results for X5

Scalability

- Intuitive to use, little to no training required
- Dynamic configurability of interfaces important to support Soldier preferences, hardware form factors and redundancy
- Planning capability on dismounted devices is desirable

Platform Control

- Smaller display form factor and soft joystick more practical for dismounted operations

Live-Virtual-Constructive Overview

POCs: Robert Scott Smith, UAMBL
Kaleb McDowell, Ph.D. ARL

RUX06 Efforts: X6 (Mixed), *Pilot (Motion Base)*

Soldiers: Soldiers (10) teamed to complete 5 trials for X6.

General Structure: An MCS platoon was attached to a RECON Troop. The MCS platoon conducted a tactical movement down a road (mixed), 5 simulated BLOS fires (virtual) on red force locations (constructive), and the lead vehicle identified civilians and hostiles located along the movement route (live). The hostiles were engaged virtually.

Primary Areas of Interest:

- Document TTPs
- Concept Validation

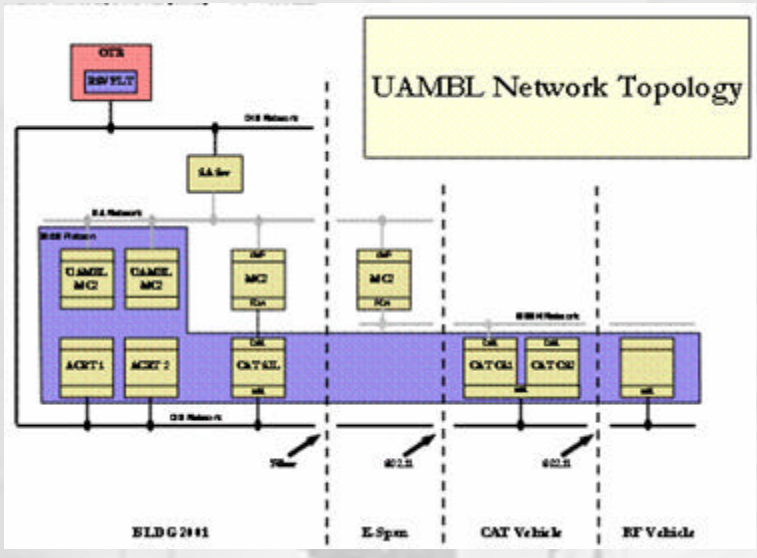
Live-Virtual-Constructive Results

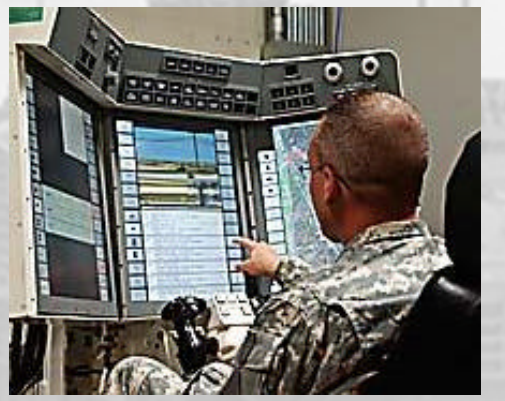
Preliminary Results for X6

Autonomous movement reduced the MCS platoon's rate of march.

Validated manned-unmanned teaming concept between MCS and ARV-R.

Documented the BLOS fire distribution TTP of an MCS Platoon.





Fire Control Overview

POC: Deborah A. Butler, AMRDEC

RUX06 Efforts: X4 (Simulation), *X6 (Mixed)*

Soldiers: Each individual (12) completed the experiment.

General Structure: Soldiers were trained to utilize the Crew Automation and integration Testbed (CAT) crew station to engage targets from their manned and unmanned assets using the FC-NET fire control system. The soldiers' ability to prioritize targets, select the appropriate asset and weapon for a specific threat, and engage targets was measured. This process was repeated with and without automated weapons pairing and target prioritization algorithms.

Primary Areas of Interest:

- Weapons pairing and target prioritization algorithms.

Local Area Awareness Overview

POC: Kelvin Oie, Ph.D., ARL

RUX06 Efforts: X5 (Simulation), *X2 (Field), X6 (Mixed), Pilot (Motion Base)*

Soldiers: Individuals are completing the experiment this week.

General Structure: Soldiers scanned for people during a simulated ride through a virtual, urban environment.

Primary Areas of Interest:

- Scanning of continuous video versus static images during mobility operations.
- Impact of increased visual area and camera panning on scanning performance.

Discussion and Recommendations

Preliminary results suggest increased Soldier performance and reduced workload through:

- Autonomy for both manned and unmanned assets.
- Crew aiding behaviors.
- Automated weapons pairing and target prioritization algorithms.

Preliminary technological assessments suggest the need to provide the Soldiers with:

- Greater potential control over the autonomy.
- Access to the “thoughts” of the autonomy.
- Clear awareness of the status of robotic convoy.
- Tasking that allows vehicle supervisors to be locally aware.